Before the
FEDERAL COMMUNNICATIONS COMMISSION
Washington, DC 20554

ET 09-38

In the Matter of

Starkey Laboratories, Inc. and Micro Ear Technology, Inc.
Request for Waiver of
Section 15.247(a)(2) of the
Commission's Rules

File No._____

FILED/ACCEPTED
NOV 1 2 2008
Federal Communications Commission
Office of the Secretary

To: Chief, Office of Engineering and Technology

Amended Request for Waiver

Starkey Laboratories, Inc., and its wholly-owned subsidiary, Micro Ear Technology, Inc. (hereinafter referred to collectively as "Starkey Laboratories") through its counsel and pursuant to Section 1.3 of the Commission's rules, hereby files this Amended Request for Waiver of Section 15.247(a)(2)'s minimum 6 dB bandwidth requirements. Starkey Laboratories requests a temporary waiver of the said minimum 6 dB bandwidth requirements until the Commission rules on its Petition for Rulemaking.[1] The purpose of the temporary waiver is to allow Starkey Laboratories to operate low power RF communication devices using a minimum amount of power and bandwidth and to roll out said devices to the public expeditiously. There is good cause to waive Section 15.247(a)(2) minimum bandwidth requirements. Waiving said requirements is in the public interest as it will speedily enable operation of hearing devices that will enhance

[1] Starkey Laboratories, Inc. filed a Request for Waiver on April 11, 2008. At OET staff's suggestion, Starkey Laboratories, Inc., and Micro Ear Technology, Inc. are filing this Amended Request for Waiver. Starkey Laboratories, Inc. also filed a separate Petition for Rulemaking on April 11, 2008 requesting that the Commission amend Section 15.247(a)(2)'s minimum 6dB bandwidth requirements.

hearing disabled patients' quality of life, make for better and more efficient use of bandwidth, and not cause any harmful interference with other uses of the relevant spectrum.

A. Background and Request for Waiver

Starkey Laboratories is a private company founded in 1967 by William F. Austin with its headquarters in Eden Prairie, MN. With thirty-five facilities in more than twenty-four countries around the globe, Starkey Laboratories is an industry leader in hearing instrument manufacturing, creating top quality diagnostic equipment, hearing protection products, wireless technology and unique hearing solutions for every environment. Starkey Laboratories is a world leader in the design, development and distribution of comprehensive hearing solutions, and believes in using superior hearing technology as a means to something even greater—creating meaningful connections between people and their worlds.

Starkey Laboratories is interested in facilitating wireless assisted listening, hearing enhancement, and configuration of hearing instruments for the hearing impaired. In order to accomplish this, Starkey Laboratories has made a significant investment in low power RF communication devices ("low power devices") in the 902 to 928 MHz ISM band.

Some of the specific devices Starkey Laboratories would expect to use in this band include:

1. Assistive listening devices ("ALDs") for sending digital audio information to a hearing aid wearer for the purpose of improving the signal to noise ratio of audio information presented in a classroom, auditorium, place of

worship, and like public venues. The specific devices may include two-way communication with the hearing aid wearer. The range of these devices should be in the order of 30 meters for indoor propagation. The anticipated bandwidth requirement is 300 KHz. The host devices will be equipped with receivers having a sufficient sensitivity to do listen before talk ("LBT") and will employ an adaptive frequency selection algorithm.

2. Wireless devices for transmitting public service announcements and alarms such as fire, smoke and CO alarms to hearing instruments. These devices may improve or even save the lives of the hearing disabled.

3. Hearing assistance devices that permit two-way digital audio communication and related control. Two-way wireless communication is necessary for bi-direction audio interface to devices that connect to a telephone network such as a cellular, PSTN, or VoIP network.

4. Programming devices for configuration and maintenance of hearing instruments. These devices would be used by hearing professionals to program critical parameters for hearing aid patients.

These low power devices will use a minimum amount of power and bandwidth to accomplish the communications necessary for maintaining a high quality of life for the hearing impaired. In developing these low power devices Starkey Laboratories has determined that operating within Section 15.249 has several technical limitations, including limited range and limited link margin, due to the physical size and power constraints of the hearing instruments. In Starkey Laboratories' experience, antennas at 900 MHz contained within a custom hearing aid are limited to -25 dBi due to the limited

area available for antennas (<80 mm^2). Further, current battery chemistry allows for no more than 4 mA maximum power drain. Below is an example link budget:

Link Budget example using 15.249

Transmit power = -1.5 dBm
Transmit antenna efficiency = 0 dBi
Free space loss over 4 meters (Friis eq) = -43.7 dB
Receiver antenna efficiency = -25 dBi
Receiver sensitivity = -90 dBm for 1E-3 BER
Body Shadow effects = -15 dB
Indoor Multi-path effects = -10 dB

-1.5 -43.7 – 25 -15 - 10 = -95.2 dBm

This example link budget shows there is insufficient power at 4 meters to achieve 1E-3 BER.

While Starkey Laboratories understands that 1 MHz centered at 217 MHz has been allocated for use with hearing assistance devices, operating the low power devices within this band would require various rule changes and modifications. Under Part 95 LPRS rules at 217 MHz, the allocation is for <50 KHz channels and the transmission is limited to one-way voice communication. In order to send medium fidelity digital audio signals approximately 200 Kbits/sec is necessary. Given a 50 KHz bandwidth allocation it will be necessary to use higher order modulation schemes requiring a large amount of signal processing at the receiver. Such signal processing of the input signal is not currently possible given the energy capacity of a typical hearing aid battery.

In addition, the allocation in the 217 MHz band is limited to 1 MHz total bandwidth which may be insufficient for multiple digital audio streams within range of one another. The current deployments of systems in this band are narrow band FM systems. Starkey Laboratories, along with other hearing aid manufacturers, envisions

future systems employing digitally modulated signals that can transmit high fidelity audio.

To effectively operate these envisioned systems and low power devices within the band allocated currently at 217 MHz would require the following modifications and/or Commission rule changes:

Allow two-way voice and data communication;
Increase the occupied bandwidth up to 300 KHz;
3 MHz total bandwidth;
Max power spectral density of = 6 dBm/10 KHz; and
Max power of +20 dBm (This is no change from the present max power).

Starkey Laboratories is, instead, interested in operating low power devices within the rules set forth in Section 15.247(a)(2),[2] but with a lower minimum bandwidth than currently allowed by the rule. Section 15.247(a)(2) currently states in part that "[t]he minimum 6 dB bandwidth shall be at least "500 kHz." Starkey Laboratories is requesting that the aforesaid language be waived and that it be allowed to operate said low power devices using digital modulation techniques with a lower minimum 6 dB bandwidth of at least "100 kHz."

The proposed waiver would allow Starkey Laboratories to operate low power devices with a lower minimum 6 dB bandwidth of **100** kHz, while maintaining the 8 dBm/3 kHz power spectral density specified in Section 15.247(e). Table 1.0 shows an example of the total radiated power that would be allowed if this waiver was granted.

[2] Starkey Laboratories filed for and experimental license on December 12, 2007, File Number 0695-EEX-PL-2007, and was granted authorization effective February 25, 2008.

Table 1

6 dB Bandwidth	Total Radiated Power	Power in Watts
<100 KHz	-1.5 dBm (Falls under 15.249)	.7 mW
100 KHz	+23.2 dBm	209 mW
200 KHz	+26.2 dBm	417 mW
300 KHz	+28 dBm	631 mW
400 KHz	+29.2 dBm	832 mW
500 KHz	+30 dBm (Maximum allowed under 15.247 (b)(3))	1 Watt
>500 KHz	+ 30 dBm (Maximum allowed under 15.247 (b)(3))	1 Watt

Normal frequency spreading techniques such as frequency hopping and direct sequence spread spectrum are not viable options in a hearing aid. Frequency hopping and spread spectrum techniques require additional power consumption over direct modulation techniques. Fast frequency hopping requires additional current in the PLL to rapidly tune the synthesizer. Direct sequence spread spectrum techniques require high speed switching at RF which increases the overall power consumption of the system. In addition, these techniques require synchronization overhead which increases the power consumption and lowers the effective throughput of the system.

Starkey Laboratories employs the use of an adaptive frequency selection algorithm by the host device that monitors the channel for a clear portion of spectrum in which to operate. The host device selects the channel for use. By selecting a clear channel for operation, Starkey Laboratories assistive listening devices avoid harmful interference from other wireless systems and additionally minimize interference to other wireless devices from the Starkey Laboratories assistive listening system.

By granting the waiver Starkey Laboratories host devices will use a narrower bandwidth than the minimum bandwidth required under 15.247 thus reducing potential interference.

Starkey Laboratories has conducted experiments and field trials using its experimental license (0695-EX-PL-2007) and found the range to be sufficient to perform all of the streaming digital audio use cases. In addition, Starkey Laboratories has tested other Part 15 devices such as 900 MHz handsets, and found no harmful or unexpected effects on these systems in the face of the Starkey Laboratories experimental equipment.

B. Public interest

Starkey Laboratories is requesting this temporary waiver in order to expeditiously enhance hearing disabled patients' overall quality of life. Starkey Laboratories believes that the hearing disabled should be able to enjoy the same quality of life as persons with normal hearing. The company is dedicated to better connecting the hearing impaired to the world in which they live through digital wireless technology.

Today, the hearing disabled face many challenges on a daily basis. Many custom hearing aid wearers may be unable to take advantage of ALDs because direct audio input connectors are not physically available on custom hearing aids. This can make for difficulties in speech understanding in public places, including airports, train stations, theaters and auditoriums. Poor signal to noise ratio may make it difficult for hearing aid wearers to understand public announcements such as bus/train arrival or next stops information. Often, they may need to remove their hearing aids in order to use currently available public ALD systems. In addition, the range on in-home ALDs are often limited to line of sight or same room usage. Further, most current communication interfaces.

require dongles, cables, or headsets and consequently they highlight the patient's disability.

There are over thirty-one million Americans with hearing problems that can be better addressed through wireless technology. The low power devices that Starkey Laboratories is developing, and for which Starkey Laboratories requests this temporary waiver would enable custom hearing aid wearers to be better connected and more seamlessly connected in various settings. For example, safety information, such as alarms and warnings, could be transmitted directly to a hearing instrument; digital audio could be utilized in class rooms or theaters without the need for expensive magnetic loop system installation; and information at public transportation venues, such as bus, train and airport terminals, could be sent directly to the hearing aid.

At present, Starkey Laboratories intends to roll out these low power devices to the public by mid-year 2010. Granting a temporary waiver would permit Starkey Laboratories to more quickly roll out this technology and more immediately improve the quality of life of the hearing disabled.

The request for waiver is also in the public interest because it makes for better and efficient use of the available bandwidth. Starkey Laboratories is proposing to maintain the same power spectral density as that of wideband digitally modulated systems presently limited to a minimum of 500 KHz (6dB Bandwidth) within a narrower bandwidth. This will limit the overall RF power for narrow band digitally modulated signals by containing the spectrum to a narrower band. This will reduce the RF interference produced by devices requiring a lower bandwidth for digitally modulated signals than 500 KHz as stated in the Section 15.247(a)(2) current language. And as

demonstrated by Starkey Laboratories and by its experiments and field tests using its experimental test license, grant of the waiver would not cause any harmful interference.

C. Conclusion

For the above reasons, and because there is good cause and it is in the public interest to expeditiously enhance the quality of life of the hearing disabled, Starkey Laboratories respectfully requests a temporary waiver of Section 15.247(a)(2)'s minimum 6 dB bandwidth requirements and that it be allowed to operate the proposed low power devices with a lower minimum 6dB bandwidth of "100 kHz" instead of the "500 kHz" required by the rule. Starkey Laboratories respectfully requests it be granted this waiver until the Commission rules on its Petition for Rulemaking.

Respectfully submitted,

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